

WHAT IS CLAIMED IS:

1. A sputtering power-supply unit comprising:  
a voltage generation section which generates  
a sputtering voltage between a negative electrode  
5 output terminal and a positive electrode output  
terminal; and  
a circuit section which reduces fluctuation in  
a sputtering current even if an arc discharge occurs  
between the negative electrode output terminal and the  
10 positive electrode output terminal.
2. A sputtering power-supply unit according to  
claim 1, wherein  
the voltage generation section comprises:  
a sputtering DC power source;  
15 a first switch section disposed on the negative  
electrode side of the sputtering DC power source;  
a second switching section disposed in a middle  
position between a plurality of mutually independent  
choke coils serially connected to the first switch  
20 means and a reverse-direction arc prevention circuit;  
a voltage detection section which detects  
a voltage generated between the negative electrode  
output terminal and the positive electrode output  
terminal; and  
25 a current detection section which detects  
a current flowing through the choke coils.
3. A sputtering power-supply unit according to

claim 2,

wherein the circuit section comprises:

an integration section which integrates an error  
between set power and power calculated from the voltage  
5 detected by the voltage detection section and the  
current detected by the current detection section;

a differential amplifier which takes an error  
between a value of the current detected by the current  
detection section and an output of the integration  
10 section as a current set value;

a pulse width varying section which varies a pulse  
width to control opening/closing of the first switching  
section in accordance with an output of the  
differential amplifier; and

15 means for stopping an operation of the integration  
section while the second switching section is closed  
when arc generation is detected based on the voltage  
detected by the voltage detection section.

4. A sputtering power-supply unit according to  
20 claim 2,

wherein the circuit section comprises:

a comparator which has hysteresis to compare the  
current valued detected by the current detection  
section with a set current value; and

25 a driving section which drives the first switching  
section in accordance with a comparison result of the  
comparator.

5. A sputtering power-supply unit according to claim 2,

wherein the circuit section comprises:

an integration section which integrates an error  
5 between power calculated from the voltage detected by  
the voltage detection unit and the current detected by  
the current detection section and set power;

a comparator which has hysteresis to compare  
a value of the current detected by the current  
10 detection section with an output of the integration  
section as a current set value;

a driving section which drives the first switching  
section in accordance with a comparison result of the  
comparator; and

15 means for stopping an operation of the integration  
means while the second switching section is closed when  
arc generation is detected based on the voltage  
detected by the voltage detection section.

20 6. A sputtering power-supply unit according to  
claim 2,

wherein the circuit section comprises:

an arithmetic circuit which divides a value  
obtained based on the set current value, the current  
value detected by the current detection means and the  
25 voltage detected by the voltage detection circuit by  
a voltage of the sputtering DC power source; and

a pulse width varying circuit which varies a pulse

width to control opening/closing of the first switching section in accordance with an output of the arithmetic circuit.

5        7. A sputtering power-supply unit according to claim 2,

         wherein the circuit section comprises:

         an integration section which integrates an error between power calculated from the voltage detected by the voltage detection unit and the current detected by the current detection section and set power;

10

         an arithmetic circuit which divides a value obtained based on a set current value obtained by the integration section, the current value detected by the current detection means and the voltage detected by the voltage detection circuit by a voltage of the sputtering DC power source;

15

         a pulse width varying circuit which varies a pulse width to control opening/closing of the first switching section in accordance with an output of the arithmetic circuit; and

20

         means for stopping an operation of the integration section while the second switching section is closed when arc generation is detected based on the voltage detected by the voltage detection section.

25        8. A sputtering power-supply unit according to claim 1,

         wherein the voltage generation section comprises:

a DC power source which generates a predetermined voltage;

a switching circuit which has a plurality of switching elements connected to bridges, and converts  
5 an output of the DC power source into a pulse output;

a transformer which receives a primary pulsed voltage from the switching circuit, and outputs a secondary pulsed voltage;

first and second diode bridges which rectify the  
10 secondary pulsed voltage output from the transformer;

a plurality of mutually independent choke coils serially connected to an output side of the first diode bridge;

a reverse voltage holding capacitor connected to  
15 an output side of the second diode bridge;

a switching section disposed between the reverse voltage holding capacitor and a middle position between the plurality of serially connected and independent choke coils and the negative electrode output terminal;

20 a voltage detection section which detects a voltage generated between the negative electrode output terminal and the positive electrode output terminal; and

a current detection circuit which detects  
25 a current flowing through the choke coils.

9. A sputtering power-supply unit according to claim 8,

wherein the circuit section comprises:

a comparator which has hysteresis to compare the current detected by the current detection section with a current set value;

5           an oscillator connected to an output of the comparator; and

a switch control section which responds to an oscillation signal transmitted from the oscillator to output a switching signal to the switching element  
10 of the switching circuit while the output of the comparator is at a high level.

10. A sputtering power-supply unit according to claim 8,

wherein the circuit section comprises:

15           an integration section which integrates an error between power calculated from the voltage detected by the voltage detection unit and the current detected by the current detection section and set power;

a comparator which has hysteresis to compare  
20 a value of the current detected by the current detection section with an output of the integration section as a current set value;

an oscillator connected to an output of the comparator;

25           a switch control section which responds to an oscillation signal transmitted from the oscillator to output a switching signal to a switching element of

the switching circuit while the output of the comparator is at a high level; and

means for stopping an operation of the integration section while the switching section is closed when arc generation is detected based on the voltage detected by the voltage detection section.

11. A sputtering power-supply unit according to claim 8,

wherein the circuit section comprises:

an arithmetic circuit which divides a value obtained based on the set current value, the current value detected by the current detection means and the voltage detected by the voltage detection circuit by a voltage of the primary side DC power source to calculate a pulse width; and

a switch control section which outputs a switching signal to a switching element of the switching circuit in accordance with the pulse width output from the arithmetic circuit.

12. A sputtering power-supply unit according to claim 8,

wherein the circuit section comprises:

an integration section which integrates an error between power calculated from the voltage detected by the voltage detection unit and the current detected by the current detection section and set power;

an arithmetic circuit which receives an output of

the integration section as a set current value, and  
divides a value obtained based on the current value  
detected by the current detection section and the  
voltage detected by the voltage detection circuit by  
5 a voltage of the sputtering DC power source to  
calculate a pulse width;

a switch control section which outputs a switching  
signal to a switching element of the switching circuit  
in accordance with an output of the arithmetic circuit;  
10 and

means for stopping an operation of the integration  
section while the switching section is closed when arc  
generation is detected based on the voltage detected by  
the voltage detection section.

15 13. A sputtering power-supply unit according to  
claim 8,

wherein the circuit section comprises:

a control section which divides a value obtained  
based on the set current value, the current value  
20 detected by the current detection section and the  
voltage detected by the voltage detection section by  
a voltage of the primary side DC power source to  
calculate a pulse width;

a sample holding circuit which holds the pulse  
25 width output from the control section; and

a switch control section which outputs a switching  
signal to a switching element of the switching circuit



in accordance with an output of the sample holding circuit.

14. A sputtering power-supply unit according to claim 8,

5           wherein the circuit section comprises:

          a control section which divides a value obtained based on the set current value, the current value detected by the current detection section and the voltage detected by the voltage detection section by a voltage of the primary side DC power source to  
10           calculated a pulse width, and samples and holds the pulse width; and

          a switch control section which outputs a switching signal to a switching element of the switching circuit  
15           in accordance with an output of the control section.

15. A sputtering power-supply unit according to claim 8,

          wherein the circuit section comprises:

          a control section which divides a value obtained  
20           based on the set current value, the current value detected by the current detection section and the voltage detected by the voltage detection section by a voltage of the primary side DC power source to calculate a pulse width, samples and holds the pulse  
25           width, and outputs a switching signal to a switching element of the switching circuit.

16. A sputtering power-supply unit which has

a negative electrode output terminal and a positive electrode output terminal, comprising:

a DC power source which generates an output of a predetermined voltage;

5 a switching circuit which has a plurality of switching elements connected to bridges, and converts an output of the DC power source into a pulse output;

a transformer which receives a primary pulsed voltage from the switching circuit, and outputs  
10 a secondary pulsed voltage;

a rectification circuit which rectifies the secondary pulsed voltage output from the transformer;

a choke coil connected to an output side of the rectification circuit;

15 a reverse voltage generation source;

a switching section disposed between the reverse voltage generation source and the choke coil;

a constant voltage element connected in parallel to the switching section; and

20 a control section which outputs a switching control signal to the switching element, and a switching control signal to control opening/closing of the switching section.

25 17. A sputtering power-supply unit according to claim 16,

wherein the constant voltage element and current detection means are serially connected in parallel to

the switching section.

18. A sputtering power-supply unit according to claim 16,

5 wherein the constant voltage element and current detection means are serially connected in parallel to the switching section, and the control section turns OFF the switching element when a current equal to/higher than a set current is detected by the current detection section, and outputs a switching control  
10 signal to the switching element when a zero current is detected by the current detection section.

19. A sputtering power-supply unit according to claim 16,

15 wherein the constant voltage element is a constant voltage power source.